TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
1.1	Purpose of Study	1
1.2	Authority and Acknowledgments	1
1.3	Coordination	2
2.0	AREA STUDIED	2
2.1	Scope of Study	2
2.2	Community Description	2
2.3	Principal Flood Problems	2
2.4	Flood Protection Measures	4
3.0	ENGINEERING METHODS	4
3.1	Hydrologic Analyses	4
3.2	Hydraulic Analyses	5
4.0	FLOOD PLAIN MANAGEMENT APPLICATIONS	5
4.1	Flood Boundaries	5
4.2	Floodways	6
5.0	INSURANCE APPLICATION	6
5.1	Reach Determinations	6
5.2	Flood Hazard Factors	6
5.3	Flood Insurance Zones	7
5.4	Flood Insurance Rate Map Description	7

BEST COPY AVAILABLE

TABLE OF CONTENTS (Continued)

		Page
6.0	OTHER STUDIES	9
7.0	LOCATION OF DATA	9
8.0	REFERENCES AND BIBLIOGRAPHY	9

FIGURE

			Page
Figure	1	- Vicinity Map	3

TABLES

			Page
Table	1	- Summary of Discharges	5
Table	2	- Flood Insurance Zone Data	8

EXHIBITS

Flood Profiles

Mississippi River Panel 01P

Flood Insurance Rate Map Index
Flood Insurance Rate Map

BEST COPY AVAILABLE

FLOOD INSURANCE STUDY

HENDERSON COUNTY,
UNINCORPORATED AREAS,
ILLINOIS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Unincorporated Areas of Henderson County, Illinois, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

This Flood Insurance Study was prepared by compiling existing hydrologic and hydraulic technical and scientific data prepared for purposes other than the National Flood Insurance Program. The data were identified as the best available at the time of compilation of this Flood Insurance Study and should depict the general conditions of the flooding sources with relative accuracy. The Federal Emergency Management Agency (FEMA) performed a cursory review and accepted the data as valid for purposes of this Flood Insurance Study and the National Flood Insurance Program. However, if better information is known to exist or has been developed since the date of this report, the information should be immediately forwarded to the Natural and Technological Hazards Division, Federal Emergency Management Agency, Chicago, Illinois for consideration for revision of this study.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were obtained from "Upper Mississippi River, Water Surface Profiles, River Mile 0.0 to River Mile 847.5" (Reference 1).

BEST COPY AVAILABLE

1.3 Coordination

On April 24, 1985, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the community and FEMA.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Henderson County, Illinois. The area of study is shown on the Vicinity Map (Figure 1). The incorporated areas within the county were excluded from this study.

The areas studied by detailed methods were selected based upon the extent and validity of available existing hydrologic and hydraulic data. Flooding caused by overflow of the Mississippi River within the county was studied in detail.

Approximate methods of analysis were used to study all remaining areas having a potential flood hazard that did not have detailed scientific or technical data available.

2.2 Community Description

Henderson County is located on the east bank of the Mississippi River in northwestern Illinois. It is bordered on the north by Mercer County, on the east by Warren County, on the south by McDonough and Hancock Counties, and on the west by Lee and Des Moines Counties, Iowa. In 1980, the population of Henderson County was reported to be 9,114 (Reference 2).

The climate in the county is humid continental with cold winters and warm, humid summers. The normal annual temperature is about 57 degrees Fahrenheit (F.). January is the coldest month with average temperatures in the mid-20s F. Rainfall is abundant, averaging about 35 inches annually. About two-thirds of the rainfall occurs from April through September (Reference 3).

Development in the Mississippi River flood plain is primarily agricultural.

2.3 Principal Flood Problems

Due to the parameter of this existing data study, information regarding flood problems in the community is obtained only from the source report (Reference 1) and any other readily available sources. None of these sources provided information relating to the flood problems in the community.

BEST COPY AVAILABLE

BEST COPY AVAILABLE

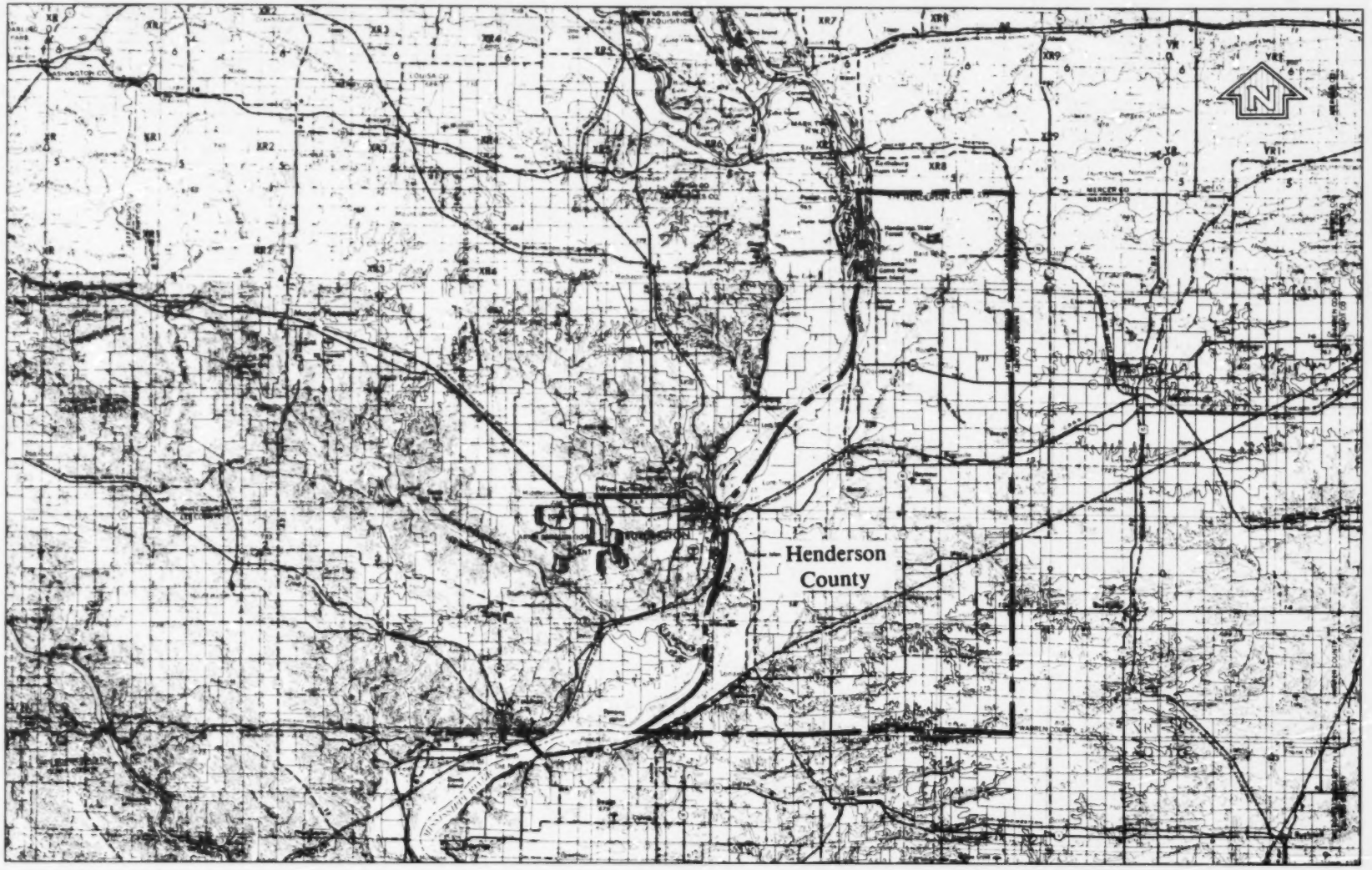


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENDERSON COUNTY, IL

(UNINCORPORATED AREAS)

APPROXIMATE SCALE

8 0 8 16 24 MILES

VICINITY MAP

2.4 Flood Protection Measures

Henderson County Drainage District No. 1 and No. 3 levees exist in the study area that provide the community with some degree of protection against flooding. However, it has been ascertained that some of these levees may not protect the community from rare events such as the 100-year flood. The criteria used to evaluate protection against the 100-year flood are 1) adequate design, including freeboard, 2) structural stability, and 3) proper operation and maintenance. Levees that do not protect against the 100-year flood are not considered in the hydraulic analysis of the 100-year flood plain.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

Discharges for the Mississippi River were determined by using data from various gaging stations on the Mississippi River (Reference 1) and by following the guidelines in the U.S. Water Resources Council Bulletin No. 17 (Reference 4).

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

BEST COPY AVAILABLE

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
MISSISSIPPI RIVER					
at downstream county boundary	119,000	245,000	315,000	350,000	410,000
at upstream county boundary	88,000	245,000	314,000	345,000	405,000

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Flood profiles for the Mississippi River were determined using gaging station rating curves (Reference 1).

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. In cases where the 50- and 100-year flood elevations are close together, due to limitations of the profile scale, only the 100-year profile has been drawn.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations shown on the profiles are, thus, considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at scales of 1:24000 and 1:62500 with a contour interval of 10 feet (References 5 and 6).

BEST COPY AVAILABLE

For the streams studied by approximate methods, only the 100-year flood plain boundary was delineated using the Flood Hazard Boundary Map for Henderson County (Reference 7).

Flood plain boundaries are indicated on the Flood Insurance Rate Map. On this map, the 100-year flood plain boundary corresponds to the boundary of the areas of special flood hazards (Zone A and numbered A zones) and the 500-year flood plain boundary corresponds to the boundary of areas of moderate flood hazards (Zone B). In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. No floodway was computed for the Mississippi River.

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting Henderson County.

5.1 Reach Determinations

Reaches are defined as sections of flood plain that have relatively the same flood hazard, based on the weighted average difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The location of the reach determined for the riverine flooding source of Henderson County is shown on the Flood Profiles and summarized in Table 2, Flood Insurance Zone Data.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

BEST COPY AVAILABLE

The FHF for a riverine reach is the weighted average difference between the 10- and 100-year flood water-surface elevations rounded to the nearest 0.5 foot, multiplied by 10, and shown as a 3-digit code. For example, if the difference between elevations is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference is greater than 10.0 feet, it is rounded to the nearest whole foot.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations are shown or FHFs determined.
Zone A9:	Special Flood Hazard Areas inundated by the 100-year flood, with base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- and 500-year floods by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and, areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding; not subdivided.

Flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community are summarized in Table 2, Flood Insurance Zone Data.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for Henderson County is, for insurance purposes, the principal product of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines for riverine flooding sources show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

BEST COPY AVAILABLE

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (FEET NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
MISSISSIPPI RIVER							
REACH 1	0005,0015,0045, 0055,0075,0080, 0085,0090,0095, 0130,0140	−4.6	−1.4	2.8	045	A9	VARIES—SEE MAP

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENDERSON COUNTY, IL

(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

MISSISSIPPI RIVER

BEST COPY AVAILABLE

6.0 OTHER STUDIES

Flood Insurance Studies have been published for the City of Dallas City, Illinois, the Villages of Oquawka, Gladstone, Lomax, and Gulfport, Illinois, the City of Burlington, Iowa, and the Unincorporated Areas of Lee and Des Moines Counties, Iowa (References 8-15).

Currently, Flood Insurance Studies are being developed for the Unincorporated Areas of Mercer and Hancock Counties (References 16 and 17).

The above-mentioned reports are in agreement with this Flood Insurance Study.

Due to its more detailed analysis, this Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for Henderson County (Reference 7).

7.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, 300 South Wacker Drive, Chicago, Illinois 60606.

8.0 REFERENCES AND BIBLIOGRAPHY

1. U.S. Army Corps of Engineers, Rock Island District, Upper Mississippi River, Water Surface Profiles, River Mile 0.0 to River Mile 847.5, 1979.

2. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Number of Inhabitants, Illinois, Washington, D.C., February 1982.

3. ————, National Oceanic and Atmospheric Administration, Environmental Data Services. Climatological Data, Asheville, North Carolina, September 1979.

4. U.S. Water Resources Council, Bulletin No. 17, Guidelines for Determining Flood Flow Frequency, March 1976.

5. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 10 feet: Burlington, 1964, revised 1976; Dallas City, 1964, revised 1975; Kingston, 1964; Lomax, 1964; Illinois-Iowa.

6. ————, 15 Minute Series Topographic Maps, Scale 1:62500, Contour Interval 10 feet: Keithsburg, 1935; Oquawka, 1934; Illinois-Iowa.

7. U.S. Department of Housing and Urban Development, Federal Insurance Agency, Flood Hazard Boundary Map, Henderson County, Unincorporated Areas, Illinois, June 1978.

BEST COPY AVAILABLE

8. Federal Emergency Management Agency, Flood Insurance Study, City of Dallas City, Hancock and Henderson Counties, Illinois, October 1983.

9. ————, Flood Insurance Study, Village of Oquawka, Henderson County, Illinois, June 1983.

10. ————, Flood Insurance Study, Village of Gladstone, Henderson County, Illinois, March 1984.

11. ————, Flood Insurance Study, Village of Lomax, Henderson County, Illinois, April 1984.

12. ————, Flood Insurance Study, Village of Gulfport, Henderson County, Illinois, October 1985.

13. ————, Flood Insurance Study, City of Burlington, Des Moines County, Iowa, July 1981.

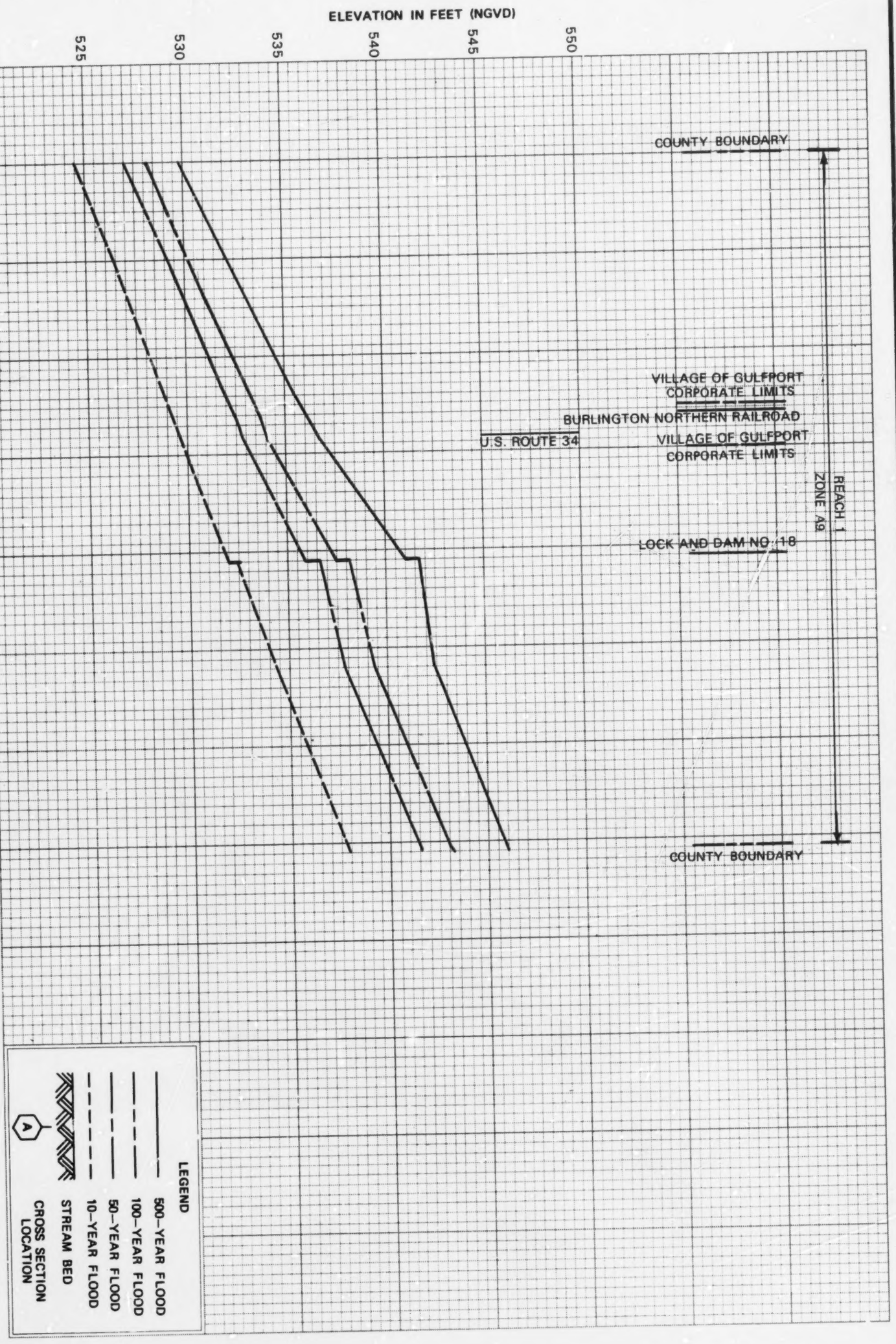
14. ————, Federal Insurance Administration, Flood Insurance Study, Lee County, Unincorporated Areas, Iowa, June 1981.

15. ————, Flood Insurance Study, Des Moines County, Unincorporated Areas, Iowa, February 1982.

16. ————, Flood Insurance Study, Mercer County, Unincorporated Areas, Illinois, in progress.

17. ————, Flood Insurance Study, Hancock County, Unincorporated Areas, Illinois, in progress.

BEST COPY AVAILABLE



STREAM DISTANCE IN MILES ABOVE CONFLUENCE OF OHIO RIVER

11.

BEST COPY AVAILABLE

01P	FEDERAL EMERGENCY MANAGEMENT AGENCY **HENDERSON COUNTY, IL** (UNINCORPORATED AREAS)	**FLOOD PROFILES** **MISSISSIPPI RIVER**